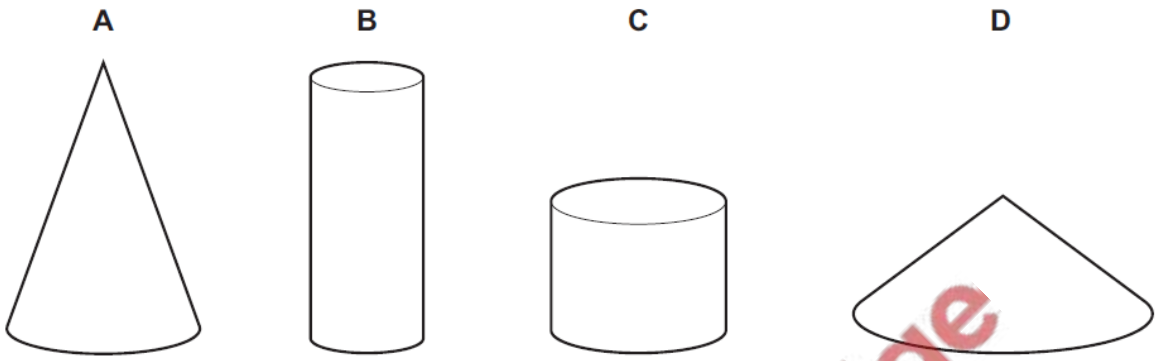
1. Nov/2021/Paper_12/No.8

Four solid objects are made from the same material and have equal volumes.

Which object is the most stable?



2. Nov/2021/Paper_21/No.1

Fig. 1.1 shows a wooden bench of weight 2000 N.

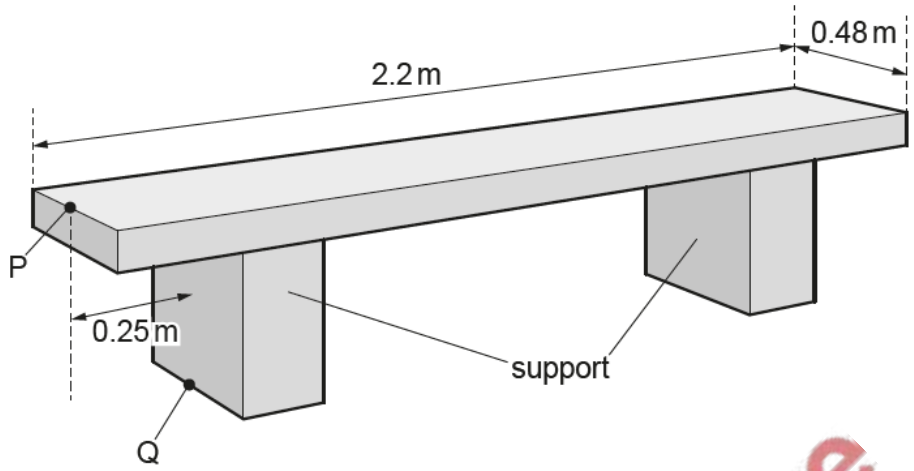


Fig. 1.1

(a) Each of the two supports has an area of 0.040 m^2 in contact with the ground.

Calculate the pressure on the ground due to the bench.

pressure = ... [2]

(b) The centre of mass of the bench is 1.1 m from the left-hand end of the bench and 0.24 m from the front.

(i) Suggest **one** reason why the centre of mass is in this position.

.....

.....

..... [2]

(ii) There is a force exerted vertically downwards from the point P shown in Fig. 1.1.

Calculate the maximum force that can be exerted vertically downwards at P without the bench rotating about the point Q shown in Fig. 1.1.

maximum force = ... [3]

3. Nov/2021/Paper_22/No.8

The turning effect of a force is measured by its moment.

(a) Fig. 8.1 shows a force *F* acting on an object at point P. The object is free to rotate about an axis at X that is perpendicular to the page.

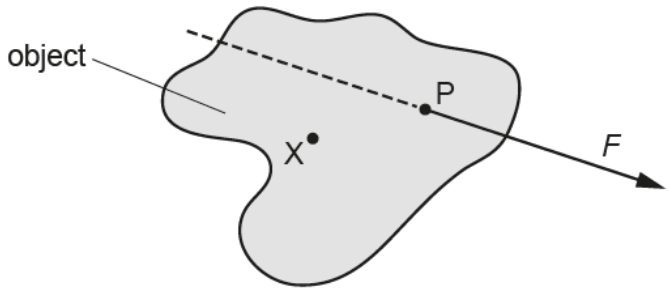


Fig. 8.1

Write down an expression for the moment of *F* about the axis at X. Draw on Fig. 8.1 to show what is meant by any other term used in your expression.

.....

..... [2]

(b) **(i)** State the principle of moments.

.....

.....

..... [2]

(ii) Describe an experiment to verify the principle of moments. Include a diagram to help the description.

.....

.....

.....

.....

.....

..... [3]

(c) A worker carries a ladder on his shoulder. His shoulder acts as a pivot. Fig. 8.2 shows that the ladder is horizontal.

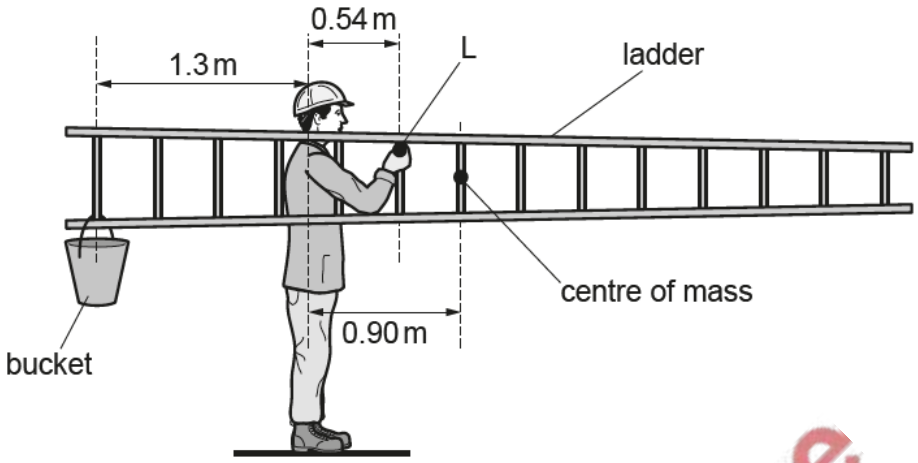


Fig. 8.2

The ladder is wider at one end than at the other end. The mass of the ladder is 8.0 kg.

(i) The gravitational field strength is 10 N / kg.

Calculate the weight of the ladder.

weight = ... [1]

(ii) State what is meant by *centre of mass*.

.....

..... [1]

(iii) The centre of mass of the ladder is not halfway along its length.

State what this shows about the ladder.

.....

..... [1]

(iv) The centre of mass of the ladder is a horizontal distance of 0.90 m from the worker's shoulder.

Calculate the moment about the worker's shoulder of the weight of the ladder.

moment = ... [2]

(v) A bucket of weight 87 N is suspended from the ladder at a horizontal distance of 1.3 m from the worker's shoulder.

The worker keeps the ladder horizontal by exerting a vertical force at point L. L is a horizontal distance of 0.54 m from his shoulder.

Determine the size and direction of the force exerted at L.

size of force = ...

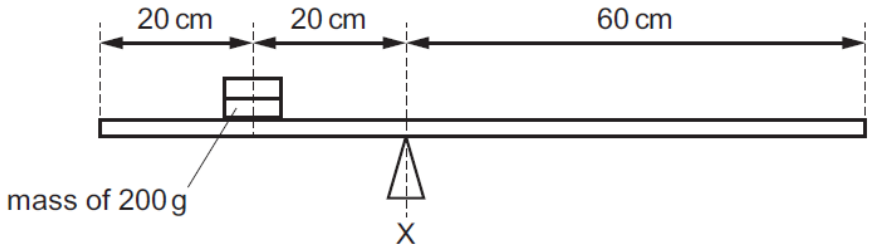
direction = ...

[3]

[Total: 15]

4. June/2021/Paper_11/No.8

A horizontal beam is pivoted at X. A mass of 200 g rests on the beam as shown. The centre of mass of the beam is 50 cm from the right-hand end of the beam.



The beam is balanced.

What is the mass of the beam?

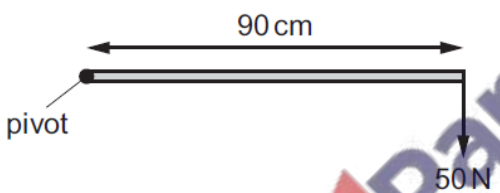
A 80 g **B** 100 g **C** 400 g **D** 800 g

5. June/2021/Paper_12/No.8

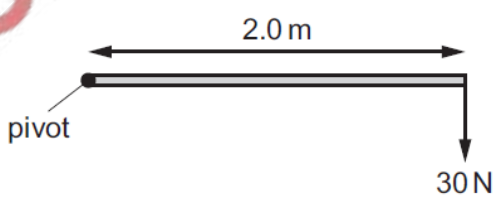
Some forces are applied at different distances from a pivot.

Which diagram shows the force that produces the largest moment about the pivot?

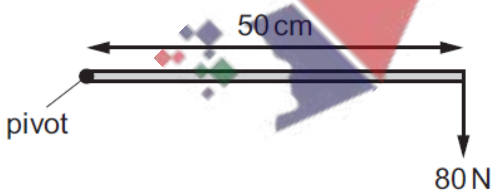
A



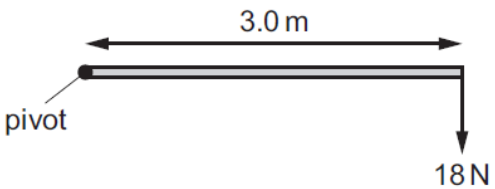
B



C



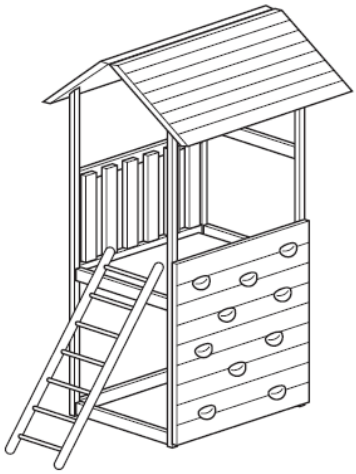
D



not to scale

6. June/2021/Paper_12/No.9

The diagram shows a children's wooden play tower.



Which change to the tower makes it more stable?

A making the tower narrower

B making the tower taller

C lowering the centre of mass

D raising the centre of mass

(b) Fig. 8.3 shows a side view of the two fences. They both have the same height and a uniform density.

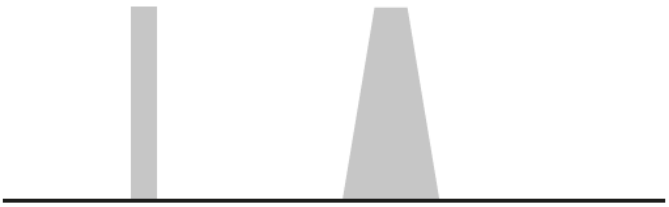


Fig. 8.3

(i) On each fence in Fig. 8.3, mark with a cross the centre of mass. [2]

(ii) Explain why a wider base makes the fence more stable.

.....

.....

..... [2]

(c) The total mass of the horse and rider is 520 kg.

(i) As they approach a fence, the horse and rider have a total kinetic energy of 4000 J.

Calculate their speed.

speed = ... [3]

(ii) The centre of mass of the horse and rider is 1.4 m above the ground.

The maximum potential energy gained by the horse and rider as they jump over the fence is 3000 J.

Calculate the maximum height above the ground of the centre of mass during the jump.

The gravitational field strength g = 10 N / kg.

height = ... [3]

8. June/2021/Paper_22/No.3

Fig. 3.1 shows a small brick hanging from a newton meter.

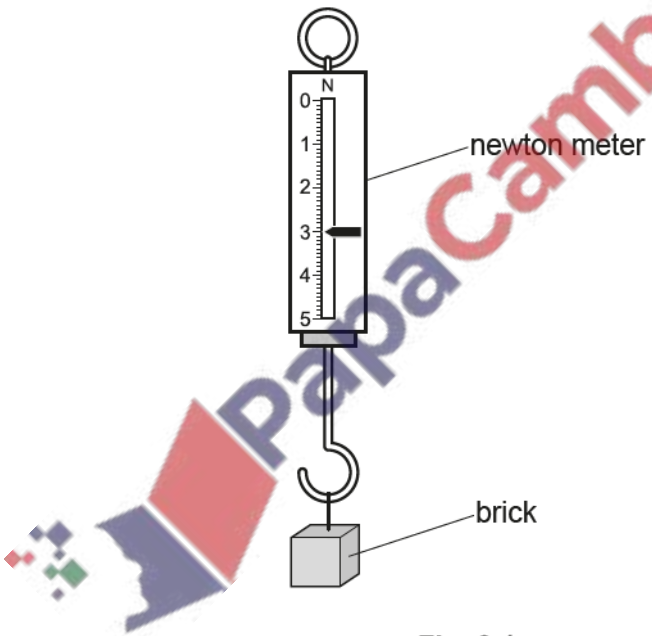


Fig. 3.1

The reading on the newton meter is 3.0 N.

(a) Describe how the reading on the newton meter is used to find the mass of the brick.

.....

..... [1]

(b) The same brick and newton meter are used in the apparatus shown in Fig. 3.2. The meter rule is pivoted at its centre and is balanced. The reading on the newton meter is not shown.

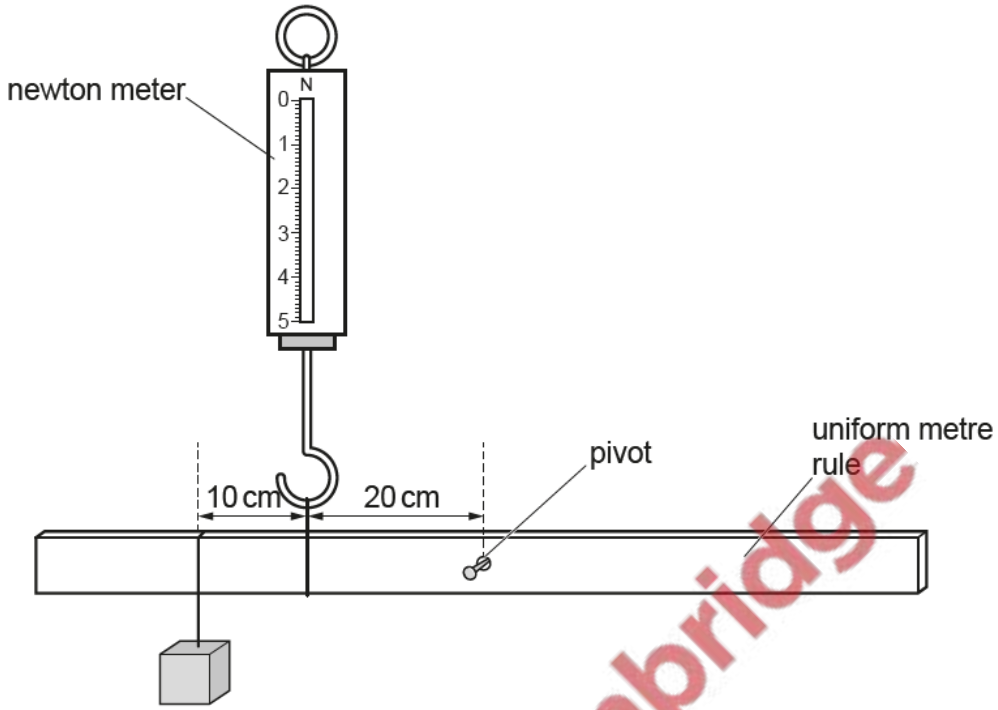


Fig. 3.2

(i) State the *principle of moments* for a body in equilibrium.

.....

.....

..... [1]

(ii) Determine the reading on the newton meter shown in Fig. 3.2.

reading = ... [2]

(c) A beaker of water is placed so that the brick is partly submerged in the water, as shown in Fig. 3.3. The apparatus is adjusted to keep the rule horizontal.

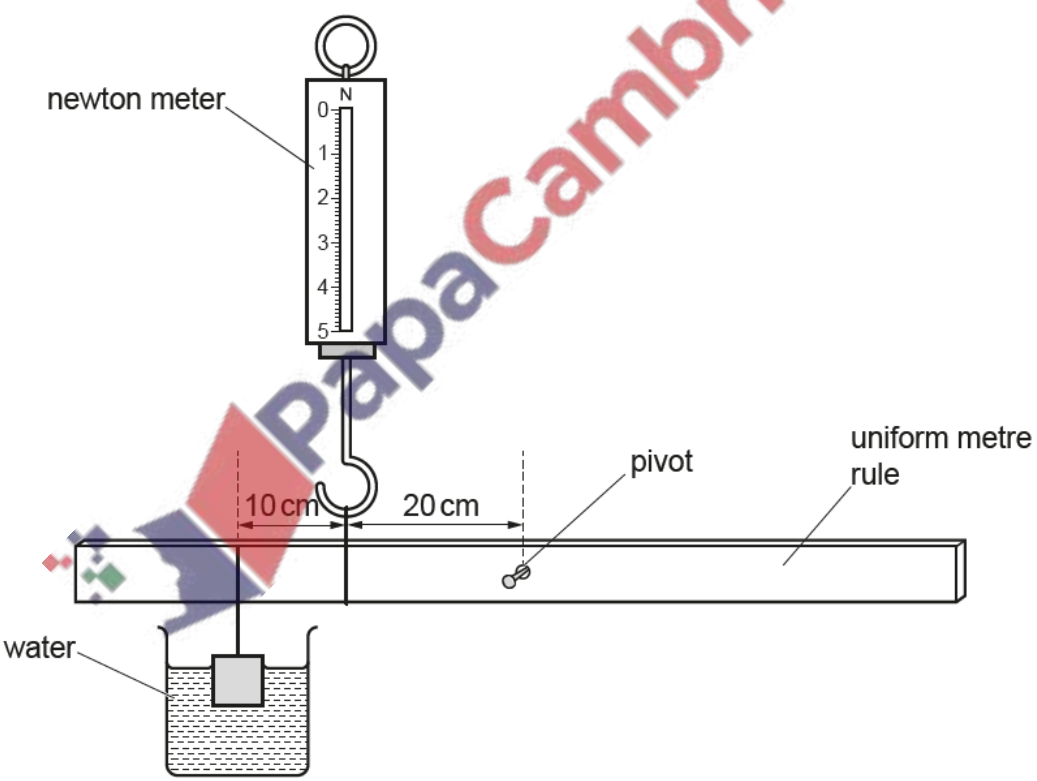


Fig. 3.3

Suggest why the reading on the newton meter is less than your answer in **(b)(ii)**.

.....

.....

..... [2]